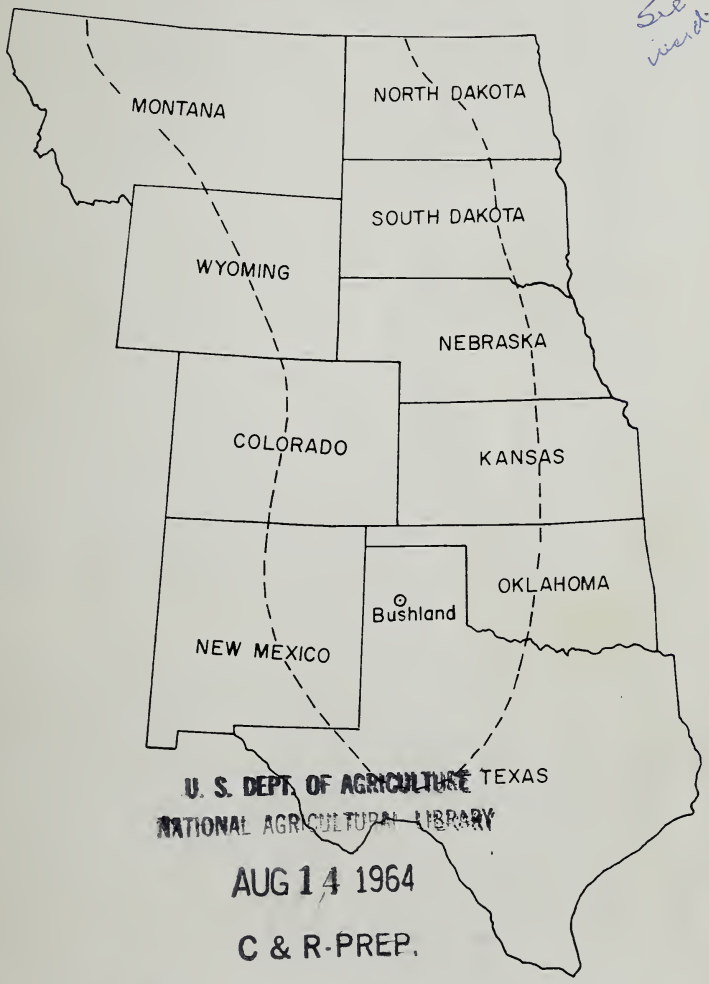
USDA

Southwestern Great Plains Field Station

Bushland, Texas

See inserts over



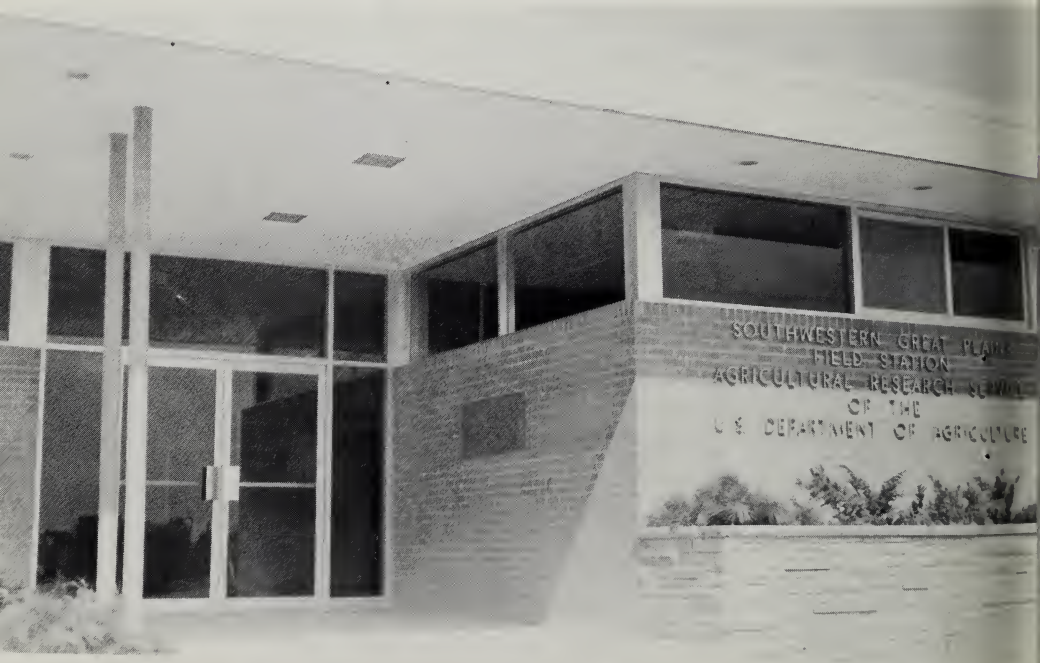
Agricultural Research Service
United States Department of Agriculture
In Cooperation With
The Texas Agricultural Experiment Station

Housed in the new facility are both ARS & T.A.E.S. research personal.

THE ROLE OF RESEARCH

In this day of science and technology, organized research develops new knowledge for solution of problems—present and future. The research at the Southwestern Great Plains Field Station emphasizes the conservation and management of soil, water, plant, and livestock resources for a prosperous agricultural economy in the Southern Great Plains.

This publication briefly describes the Station, some of the problems in the region, and some of the research in progress. Scientists and engineers of the Soil and Water Conservation Research Division and the Agricultural Engineering Research Division of the Agricultural Research Service and the Texas Agricultural Experiment Station are cooperating in conducting research at the Southwestern Great Plains Field Station to meet present and future needs.



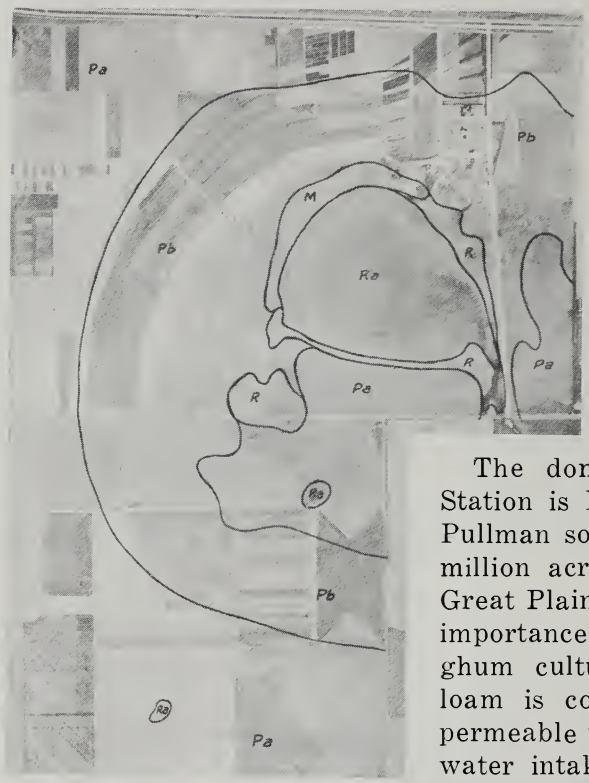
New office and laboratory building

SOUTHWESTERN GREAT PLAINS FIELD STATION

The Southwestern Great Plains Field Station is a research center for the Southern Great Plains. The land was purchased by the Federal Government in July 1936. Research was started on this Station in the spring of 1938 by the Soil Conservation Service and the Texas Agricultural Experiment Station. Early research involved stubble mulch tillage, moisture conservation, wind erosion control, wheat improvement, grass reseeding, and livestock management.

In 1953, the conservation research was transferred to the Bureau of Plant Industry, Soils, and Agricultural Engineering. In 1954, it was assigned to the Soil and Water Conservation Research Division of the Agricultural Research Service. In 1956, the Station was designated as the Southwestern Great Plains Field Station.

SOILS ON THE SOUTHWESTERN GREAT PLAINS FIELD STATION



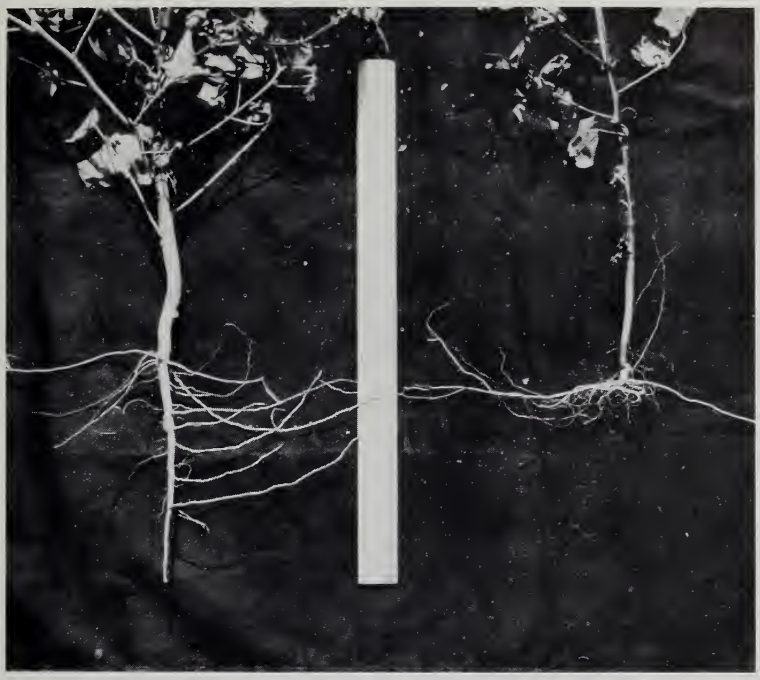
Legend

M Mansker loam, 3 to 8 percent slopes
Pa Pullman clay loam 0 to 1 percent slopes
Pb Pullman clay loam, 1 to 3 percent slopes
R Roscoe clay
Ra Randall clay

The dominant soil on the Station is Pullman clay loam. Pullman soils occur on over 5 million acres in the Southern Great Plains and are of major importance in wheat and sorghum culture. Pullman clay loam is compact and slowly permeable to water. The basic water intake rate of this soil is less than 0.05 inch per hour. The surface soil contains approximately 30 percent clay and 30 percent silt. A caliche layer of highly calcareous clay occurs at 4 to 6 feet on the Station.

Research is also being conducted on other major soils in the Southern Great Plains such as the coarser textured, wind-erosive Amarillo type soils in the cotton-producing areas around Big Spring and Lubbock.

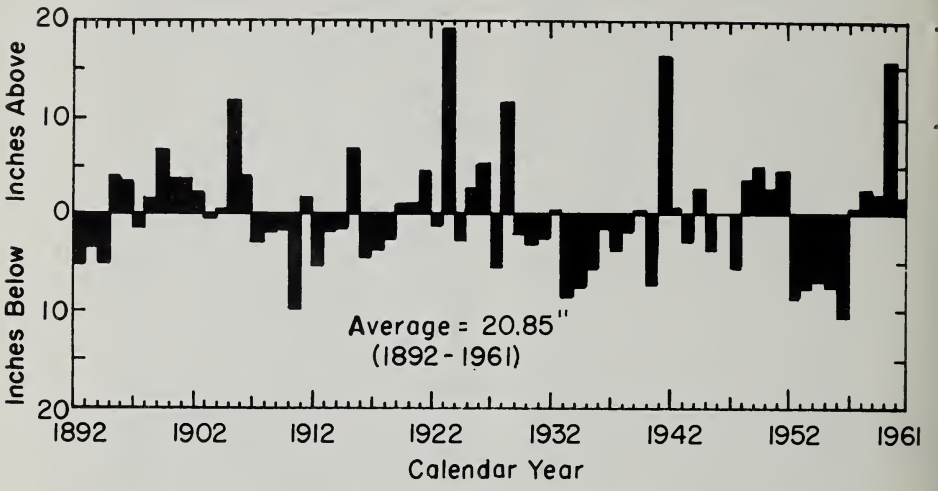
SOIL COMPACTION AND STRUCTURE



Plowpans, which are compacted soil layers immediately below usual depth of tillage, and naturally dense soil layers prevent normal root development. The problem may exist through a wide range of soil textures but is more severe in fine sandy loam soils that occur widely in the Southern Great Plains. These dense soil layers become very hard as the soil dries, which oftentimes prevents root penetration and normal development.

The roots of the cotton plant **B** in the photograph did not penetrate the compacted soil layer. This condition lessens the plant's efficiency in using moisture and nutrients below the compacted layer. Research is underway to determine causes and effects of this condition and to develop methods for improving and preventing plowpan conditions. Plowing deep enough to break up plowpans and keeping the soil moist by irrigation are two effective means of handling plowpan soils.

CLIMATE IS SEMIARID WITH HIGHLY VARIABLE RAINFALL



VARIABILITY OF ANNUAL RAINFALL AT AMARILLO, TEXAS, 1892-1961

Annual rainfall at the station averaged 18.7 inches for the past 23 years of record but has varied from a low of 12.1 inches to a high of 32.6 inches. The above chart illustrates the wet and dry years and cycles using 70 years of data from the Amarillo Weather Bureau Station. Seventy-four percent of the rainfall normally occurs during the 6-month growing season, April through September.

The high evaporation (88 inches annually from free water surfaces) and the low rainfall (18.7 inches annual average) makes the climate semiarid. Temperatures in the past 23 years have ranged from -14 to 109 degrees. Temperature exceeds 100 degrees an average of 5 days a year and goes to zero or below one or more days each year. Low humidity and high elevation (3800 feet) provide a pleasant climate.

CLMATIC FACTORS GOVERN USE OF WATER IN GROWING CROPS

Efficient use and management of water for crop growth on irrigated and nonirrigated land is a major problem in the Southern Great Plains. Farming in such a dry climate with erratic rainfall involves many decisions in type and timing of operations.

The photograph shows instrumentation for studying the effects of temperature, humidity, evaporation, wind, and solar energy on water use in the growing of grain sorghum. Knowledge gained from this research is being used to develop improved water conservation and management practices for irrigated and nonirrigated land.

WATER CONSERVATION AND MANAGEMENT

Water has long been recognized as the first limiting factor in farming and ranching in the Southern Great Plains. Many years there are periods of too little and may be one or more short periods of too much rainfall. The water supply available from rainfall and groundwater for irrigation must be used efficiently to maintain a stable agriculture.

New knowledge is needed in order to develop more efficient use of rainfall and stop depletion of the irrigation water supply. Water management research at the Southwestern Great Plains Field Station involves three phases: (1) dryland water management, (2) playa lake water management, and (3) irrigation water management. Runoff during heavy rains is a problem common to all three phases of the work.

WATER CONSERVATION ON NONIRRIGATED LAND

Heavy rains in the Southern Great Plains cause runoff and erosion losses. This runoff water should be used for crop growth.

The photograph shows some field research under way. The Zingg conservation bench terraces in the center spread water evenly over level benches after 6.2 inches of rain during the week of June 5, 1960. The level closed-end terraces in the foreground concentrated water in the terrace channels which benefits a much smaller area than the level benches and sometimes causes drowning of crops. Graded terraces in the background did not impound water.

During a 4-year period, the conservation bench terrace system increased soil moisture supplies enough to produce 50 percent more grain than conventional terraced fields. The benches were cropped annually to grain sorghum and the areas between benches (runoff contributing areas for the benches) were cropped in a fallow-wheat-sorghum sequence.

WATER INTAKE

Low water intake rates for many soils in the Southern Great Plains is a major conservation problem. The basic intake rate for Pullman soils is as low as 0.05 inch per hour. This water intake problem is common to both irrigated and nonirrigated land.

Research is showing that something can be done to increase intake rate. Many soil treatments are being studied under field conditions in order to develop practices for improving this soil condition. The photograph shows the effect of previous crop and tillage practices on water intake rate following a 5-inch preplanting irrigation for wheat.

PLAYA LAKE WATER MANAGEMENT

Runoff water in the Southern High Plains accumulates in shallow wet weather lakes known as playa lakes. An estimated 1.4 million acre-feet of water accumulates in playa lakes each year and 90 percent of this water evaporates. This is enough water to irrigate 1 million acres of land.

Limited research is underway to: (1) determine amount and frequency of runoff into playa lakes; (2) develop design systems for concentrating, pumping, and distributing lake water on cropped areas; and (3) develop low cost and effective methods for removing sediment from lake water and recharging underground reservoirs through multipurpose wells.

IRRIGATION WATER MANAGEMENT

About 7 million acres are being irrigated from underground water storage in the Southern Great Plains. Very little of the pumped water is being replaced. Improved irrigation design and management practices are urgently needed to conserve this water supply.

Irrigation water management research has been conducted for winter wheat, grain and forage sorghum, cotton, alfalfa, and potatoes. Results have shown how much water crops use, how efficiently it is used under different conditions, and when and how often to irrigate. The influence of row spacing, planting rate, crop rotations, tillage practices, and fertilizer on water use efficiency is being studied. Work is also underway to determine proper grade and length of run to reduce runoff and erosion losses from irrigated land.

STUBBLE MULCH TILLAGE DECREASES EROSION

Wind and water erosion are major soil conservation problems in the Southern Great Plains. Drought periods and high wind velocities combine to make wind erosion a major hazard.

The photograph contrasts different types of tillage and their effects on soil cover. Maintaining protective crop residue on the soil surface through stubble mulch tillage has proved to be an effective erosion control measure. In addition, stubble mulch tillage on the Station has increased wheat yields by 15 percent over clean tillage.

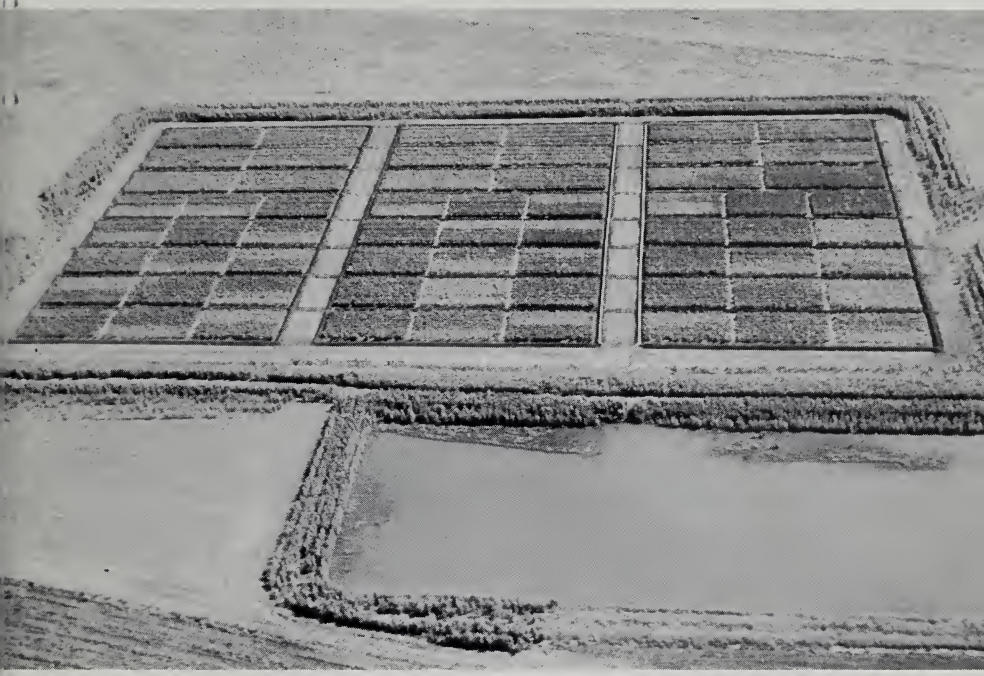
PLANT NUTRIENTS INCREASE WATER USE EFFICIENCY

Plant nutrient deficiencies in soils of the Southern Great Plains are a major factor limiting irrigated crop growth and efficient use of water.

Both plots in the photograph received a preplant irrigation and 3 irrigations after planting. The plot on the left received 240 pounds per acre of nitrogen and produced 7820 pounds of grain per acre. The plot on the right received no nitrogen and produced 2980 pounds per acre. Addition of nitrogen increased water use efficiency from 151 to 374 pounds of grain per acre-inch of water used.

Economic studies are being made to determine the most profitable levels of water and fertilizer applications for irrigated crops. Profit-maximizing farm plans are being developed for farm situations typical to high plains agriculture.

PRODUCTIVITY OF EXPOSED SUBSOIL RESTORED



Where topsoil is lost through erosion or removed by land leveling, management of exposed subsoil for crop production becomes a problem.

The photograph shows field research where plant nutrient needs are being determined for an area where varying amounts of topsoil had been removed or added. Plots varied from 16 inches of removal (foreground) to 12 inches of fill (background). Productivity of exposed subsoils was restored through application of nitrogen and phosphorus as indicated by the darker foliage of the grain sorghum.

CROP IMPROVEMENT

Research directed toward the improvement of wheat, oats, barley, and sorghum has been conducted on the Station since its establishment in 1938. The major portion of this program has been concerned with hard red winter wheat. This Station has had a part, either by selection, testing, or seed increase, in the distribution of the varieties Westar, Crockett, Concho, and Tascosa. The present program consists of developing varieties with good milling and baking characteristics as well as cold and drought hardiness, disease and insect resistance, and other desirable agronomic characteristics.

Special emphasis is being given to development of short or semidwarf varieties specifically adapted to irrigation. In recent years, male-sterile wheats have been developed and studies concerning their utilization in producing hybrid wheat and hybrids of wheat and wheat relatives such as rye and wheat grasses are being conducted. A rather intensive program is being conducted to develop wheat resistance to the greenbug.

CONTROL OF INSECT PESTS

Greenbug infestations constitute a continuing threat to small grain production in the Southern Great Plains. During some years, wheat yields may be greatly reduced by greenbug attacks. Other pests such as mites and wireworms also cause serious damage under certain conditions.

Research is developing new and more effective methods for controlling greenbugs. The photograph shows the effects of Di-Syston soil treatment on the control of greenbugs in one-row test plots.

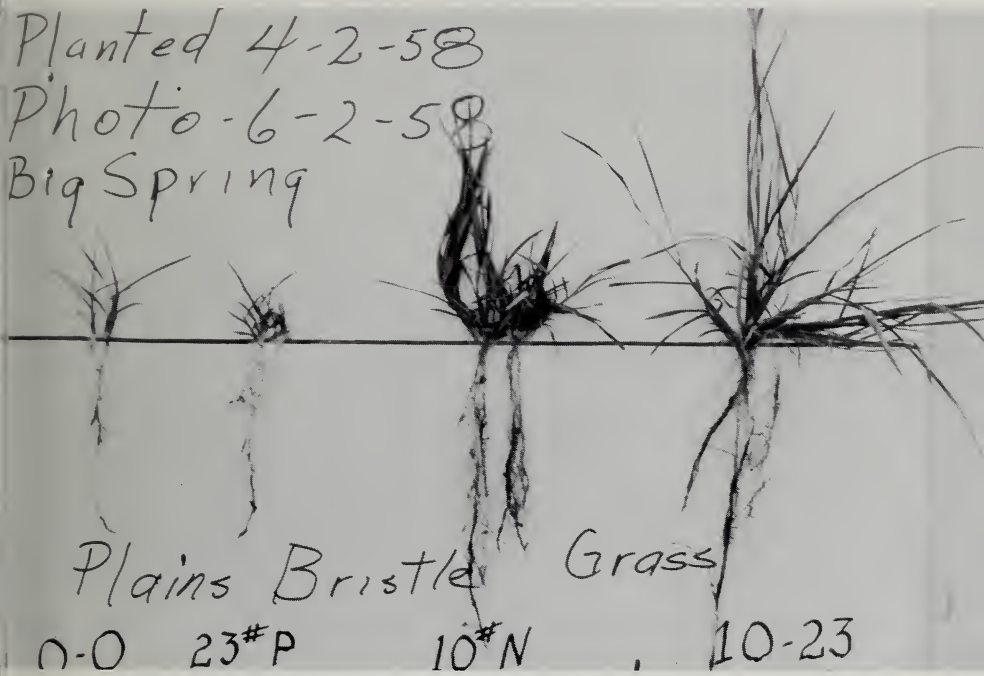
WEED CONTROL

Weeds use tremendous quantities of water in the Southern Great Plains where moisture conservation is so necessary for the growth of crops. Weed control is an expensive, though essential, operation.

Research is showing how new herbicides can be used for more effective weed control. Economical weed control methods have been developed for specific problem weeds such as field bindweed, bur ragweed, blueweed, and Johnson grass. The use of herbicides for weed control on fallow is being studied in order to maintain more effective soil cover for erosion control and moisture conservation.

The photograph illustrates the control of pigweeds in sorghum by application of propazine as a pre-emergence spray. The herbicide was applied at the rate of ½ pound per acre in 10-inch bands over the sorghum rows. No herbicide was applied over a 30-inch zone between rows where weeds can be killed easily by cultivation.

GRASS ESTABLISHMENT



Getting good grass cover established on depleted grassland and on cropland that should be returned to grass is a major conservation problem in the Southern Great Plains. Erratic rainfall and rapid drying of the soil surface interferes with germination and establishment of grass seedlings in this region.

Research is underway to develop better seeding and fertilizing equipment and its use for grass establishment. The effect of small amounts of nitrogen and phosphorus added to the soil at seeding time on the growth and development of grass is shown in the photograph.

CONSERVATION AND USE OF GRASSLAND

Maintenance of effective cover on grasslands in the Southern Great Plains for moisture conservation and erosion control is a major problem. The proper balance between amount of forage removed by grazing and the amount of cover to leave for conservation is difficult to determine.

Limited research is underway at this station on grassland management and use of forage and grain grown in irrigated and dryland farming for livestock production. Studies have shown that beef cattle offer an excellent means of marketing native grass, winter wheat pasture, sorghum fodder, grain, and silage. Steers fed in drylot consistently returned from $7.50 to $10 per ton of silage consumed. This provides net returns of $75 to $100 per acre from silage produced under irrigation.

Published with Texas Agricultural
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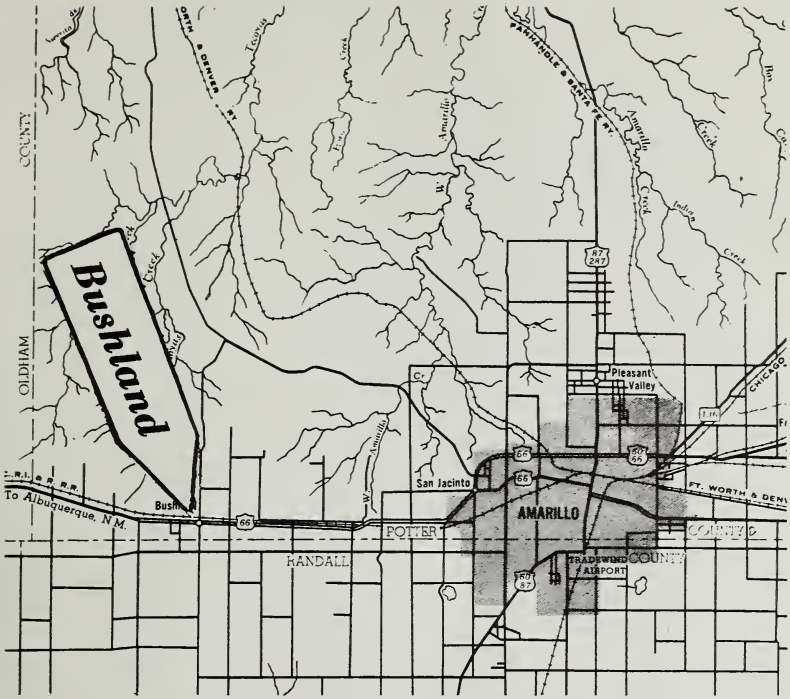

DEDICATION PROGRAM

for the

SOIL AND WATER CONSERVATION RESEARCH LABORATORY

USDA SOUTHWESTERN GREAT PLAINS FIELD STATION

Bushland Texas

October 3, 1962, Two O'Clock

Art Bralley, Presiding

National Anthem ..... Amarillo Air Force Band

Invocation ..... Rev. Jordan Grooms
Pastor, Polk Street Methodist Church, Amarillo

Recognitions

Introduction of President of TASCD ..... Mr. Frank Gray
State Soil Conservation Board

Twenty-fifth Anniversary of Soil Conservation Districts ..... Mr. John D. Wells
President, Association of Texas Soil Conservation Districts

Introduction of Congressman from 18th District ..... Mr. Art Bralley
Vice President, American National Bank

Address ..... Hon. Walter Rogers
Congressman, 18th District Texas

Introduction of Dedication Speaker ..... Dr. M. T. Harrington
Chancellor, Texas A & M College Station

Dedication Address ..... Dr. Byron T. Shaw
Deputy Administrator, Agricultural Research Service

Benediction ..... Rev. J. E. Burkham
Pastor, First Baptist Church, Bushland

THE HONOR OF YOUR PRESENCE IS REQUESTED

at the dedication of the

SOIL AND WATER CONSERVATION RESEARCH LABORATORY

USDA SOUTHWESTERN GREAT PLAINS FIELD STATION

Bushland, Texas

Wednesday, October 3, 1962, 2:00 P.M.

Co-sponsored by

THE FARM AND RANCH COUNCIL

AMARILLO CHAMBER OF COMMERCE